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PATENT APPLICATION
Attorney's Do. No. 1482-138

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Barrie Gilbert

Serial No. 09/694,731 Examiner: Quan Tra

Filed: October 23, 2000 Group Art Unit: 2816

For: LOW SUPPLY CURRENT RMS-TO-DC CONVERTER

Date: September 3, 2002

ATTENTION: Board of Patent Appeals and Interferences
Commissioner of Patents and Trademarks
Washington, DC 20231

I HEREBY CERTIFY THAT THIS CORRESPONDENCE IS BEING DEPOSITED WITH THE UNITED STATES POSTAL SERVICE AS FIRST CLASS MAIL IN AN ENVELOPE ADDRESSED TO: BPAI
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ON Sept. 3, 2002

TRANSMITTAL OF APPEAL BRIEF

This Appeal Brief is in furtherance of the Notice of Appeal mailed in this case on June 3, 2002. Appeal is taken from the Examiner's Office Action mailed March 12, 2002, finally rejecting claims 1, 3-12, 14 and 15.

Also enclosed is:

☒ Form PTO-2038 authorizing payment in the amount of $430.00 for the appeal fee ($320.00) and a 1-month extension fee ($110.00).

☒ Applicant petitions the Commissioner to extend the time for response. The extension fee is included and a duplicate copy of this form is enclosed.

☒ Any deficiency or overpayment should be charged or credited to deposit account no. 13-1703.

Respectfully submitted,

MARGER JOHNSON & McCOLLOM, P.C.

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J. McMillan
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ATTENTION: Board of Patent Appeals and Interferences
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APPEAL BRIEF

This Appeal Brief is in furtherance of the Notice of Appeal mailed in this case on May 30, 2002. Appeal is taken from the Examiner's Office Action mailed March 12, 2002, finally rejecting claims 1, 3-12, 14 and 15.

The fees required under §1.17(c) and any required petition for extension of time for filing this Brief and fees therefor are submitted with the accompanying TRANSMITTAL OF APPEAL BRIEF.

This Brief is submitted in triplicate.

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REAL PARTY IN INTEREST

The present application has been assigned to the following party:

Analog Devices, Inc.
One Technology Way
Norwood, MA 02062

RELATED APPEALS AND INTERFERENCES

The Board's decision in the present Appeal will not directly affect, or be directly affected, or have any bearing on any other appeals or interferences known to the appellant, or to the Applicant's legal representative.

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STATUS OF CLAIMS

Claims in the application: 1, 3-12, 14 and 15

Claims allowed: None

Claims rejected: 1, 3-12, 14 and 15 (all of which are finally rejected)

Claims appealed: 1, 3-12, 14 and 15

STATUS OF AMENDMENTS

A Response to Office Action was filed on November 19, 2001 and received by the U.S. Patent and Trademark Office on January 8, 2002. All amendments have been entered by the Examiner.

SUMMARY

The claims on appeal relate to squaring cells which are used to generate an output signal that is equal to the mathematical square of an input signal applied to the cell. The particular squaring cells at issue provide a good mathematical square-law approximation over a limited input signal range (that is, when the input signal is below a certain value). If the input signal becomes too large, the square-law approximation begins to break down, and the squaring cell loses accuracy. The range of input signals over which the squaring cell maintains its accuracy is related to the steady-state current (also called the "quiescent" or "bias" current) through the cell (see page 4 of the specification at lines 28-29) and to the temperature of the cell (see page 2 of the specification at lines 10-11).

Claims 1, 3-7 and 15 relate to methods for operating squaring a cell.

Claims 8-12 and 14 relate to squaring cells that compensate for temperature changes.

ISSUES ON APPEAL

Whether claims 1-3-12 and 14 are unpatentable under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 4,250,457 to Hofmann ("Hofmann") and whether claim 15 is unpatentable over Hofmann under 35 U.S.C. 103(a).

GROUPING OF CLAIMS

Claims 1, 3 and 5-7 stand together. Claims 8-12 and 14 stand together.

<u>ARGUMENT</u>

<u>Rejections under 35 U.S.C. § 102</u>

Claims 1, 3-12 and 14 are not anticipated by U.S. Patent No. 4,250,457 to Hofmann ("Hofmann").

Claim 1 recites a method for operating a squaring cell and includes the limitation of "limiting the input signal to a range in which the output function of the transistor cell approximates a square-law." As discussed above in the summary, the square-law approximation of the squaring cell begins to break down when the input signal becomes too large. Thus, the desirability of limiting the input signal. Hofmann does not disclose limiting the input signal in any way. In fact, as will be discussed below, Hofmann actually discloses the desirability of using a large input signal to achieve a linear response, thereby *avoiding* a square-law response.

Applicant set forth a similar argument in the Response to Office Action filed November 19, 2002. In the Final Office Action mailed March 12, 2002, the Examiner responded (at page 5) that this argument was not persuasive. The Examiner pointed to an equation at col. 5, lines 15-18 of Hofmann and argued that this equation showed that the output function of Hofmann's transistor cell approximates a square-law.

The Examiner's analysis is incomplete, however, because the equation at col. 5, lines 15-18 of Hofmann actually has two regimes of operation: (1) when the input signal is relatively small, the cell approximates a square-law; and (2) when the input signal is relatively large, the cell provides a linear (absolute value) function. (The equation at col. 5, lines 15-18 of Hofmann is essentially the same as Eq. 1 at page 4, line 10 of Applicant's specification, except for minor differences in notation. These two regimes of operation are explained in more detail at page 4, line 8 - page 5, line 2 of the specification.)

Even had the Examiner provided this more complete analysis, however, it would not establish that claim 1 is anticipated by Hofmann. That is, even if a second possible mode of operation can be discerned through a careful study of the reference, it does not mean that the reference teaches the step of limiting the operating parameters to this second mode. Hofmann does not teach "limiting the input signal to a range in which the output function of the transistor cell approximates a square-law" as recited in claim 1. Moreover, as mentioned above, and as will be explained in more detail below, Hofmann actually teaches the desirability of using a larger input signal range.

Claim 4 depends from claim 1 and recites varying the bias signal with temperature such that it causes the bias current to be proportional to absolute temperature ("PTAT"). Claim 8 recites a squaring cell having a bias signal generator that generates a bias signal that varies with temperature such that it causes the bias current through each of the transistors to be proportional to absolute temperature.

In the Final Office Action mailed March 12, 2002, the Examiner apparently alleges (at page 5) that these PTAT limitations are disclosed in Fig. 2 and at col. 5, lines 15-18 of Hofmann. However, Hofmann's Fig. 2 is discussed at col. 5, lines 31-58 where there is no mention of any temperature dependency. And col. 5, lines 15-18 of Hofmann is simply the equation that was discussed above; this equation shows no temperature related effects. Thus, claim 4 is not anticipated by Hofmann.

Also at page 5 of the Final Office Action mailed March 12, 2002, the Examiner argues that the language "such that" in claim 4 is a "result." This is incorrect. The language "such that" in claims 4 and 8 is defining the limitation functionally, and there is nothing wrong with defining some part of an invention in functional terms. *See* MPEP § 2173.05(g) and cases cited therein.

The Examiner then argues that the apparatus in Hofmann's Figs. 1 and 2 appears similar to Applicants' Fig. 1, and therefore, the currents through each of Hofmann's transistors is also PTAT. This argument, however, is based on the assumption that the currents in Applicant's Fig. 1 are necessarily PTAT.

<u>Rejections Under 35 U.S.C. § 103</u>

Claim 15 is not obvious over Hofmann. Claim 15 recites a method for operating a squaring cell in which the input signal is limited to less than about four times the bias current. At page 4 of the Final Office Action mailed March 12, 2002, the Examiner acknowledges that Hofmann does not teach this limitation, but then argues that this selection of current range would have been an obvious "design choice" depending upon the particular environment of use to ensure optimum performance. This argument, however, is based on the faulty assumption that Hofmann actually teaches limiting the input signal range. It cannot be obvious to select a specific input signal range when the prior art does not teach limiting the input signal to *any* range.

Moreover, Hoffman actually teaches away from limiting the input signal range. As mentioned above, Applicant's specification explains that the squaring cells have two distinct

modes of operation. If the input signal applied to the squaring cell is limited to less than about ±4 times the bias current, the squaring cell provides a good square-law approximation. That is, the operation of the squaring cell is limited to the curved (i.e., nonlinear) portion of the solid curve shown in Fig. 2 of Applicant's specification. (See the specification at page 4, lines 8-22 and page 4, line 28 - page 5, line 2.) If, however, the input signal is relatively large, the output is approximately equal to the absolute-value of the input signal; that is, the output of the cell becomes a linear function which is shown in Applicant's Fig. 2 as a broken line for comparison. (See the specification at page 4, lines 23-27.)

Hofmann does not teach or suggest limiting the input signal to a squaring cell. The entire thrust of Hofmann is to achieve a linear operating characteristic. (See, e.g., col. 1, lines 8, 15 and 17; col. 2, line 46; col. 4, lines 7-9; col. 5, lines 19-21; col. 6, lines 3 and 14; etc., all emphasizing the desirability of achieving high linearity.)

At col. 5, lines 19-21, Hofmann expressly states the advantage of making the input signal (I_{in}) much large than the bias current (I_b) for the purpose of achieving a linear output. This is in contrast to claim 15 which recites limiting the input signal to a specific range that provides a nonlinear square-law characteristic.

Hofmann's only hint of nonlinear operation is at col. 5, lines 21-25 where it mentions that the detector might be useful for applications where it is desirable to generate a signal corresponding to the square root of the sum of the square of two inputs. But this is far from the simple square law approximation recited in claim 15, and there is no suggestion or motivation to limit the input signal in any way as recited in claim 15.

CONCLUSION

Applicant requests that the rejection of claims 1, 3-12, 14 and 15 be reversed.

Respectfully submitted,
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APPENDIX

The claims of the present application read as follows:

1. A method for operating a transistor cell comprising an input terminal for receiving an input signal, an output terminal for transmitting an output signal, a grounded base transistor coupled between the input and output terminals, and a current mirror coupled between the input and output terminals, the method comprising:

biasing the transistor cell to establish a bias current in the grounded base transistor and the current mirror when the input signal is zero; and

limiting the input signal to a range in which the output function of the transistor cell approximates a square-law.

2. (Cancelled)

3. A method according to claim 1 further including adjusting the bias current, thereby adjusting the input impedance of the cell.

4. A method according to claim 1 wherein biasing the transistor cell includes:

coupling a bias signal to the base of the grounded base transistor; and

varying the bias signal with temperature such that it causes the bias current through the grounded base transistor and the current mirror to be proportional to absolute temperature.

5. A method according to claim 1 wherein:

the current mirror is coupled to a power supply terminal; and

biasing the transistor cell includes maintaining the base of the grounded base transistor at about $2V_{BE}$ from the voltage of the power supply terminal.

6. A method according to claim 1 further including isolating the current mirror from the output terminal.

7. A method according to claim 6 wherein isolating the current mirror includes coupling a cascode transistor between the output terminal and the current mirror.

8. A squaring cell comprising:

an input terminal;

an output terminal;

a grounded base transistor coupled between the input and output terminals;

a current mirror coupled between the input and output terminals; and

a bias signal generator coupled to the grounded base transistor to establish a bias current through the grounded base transistor and the current mirror, wherein the bias signal generator generates a bias signal that varies with temperature such that it causes the bias current through each of the transistors to be proportional to absolute temperature.

9. A squaring cell according to claim 8 further including a cascode transistor coupled between the current mirror and the output terminal.

10. A squaring cell according to claim 8 wherein the current mirror is coupled to a power supply terminal, and the bias signal generator maintains the base of the grounded base transistor at about $2V_{BE}$ from the voltage of the power supply terminal.

11. A squaring cell according to claim 8 wherein the current mirror includes:

a diode-connected transistor coupled between the input terminal and a power supply terminal; and

a mirror transistor having a collector coupled to the output terminal, a base coupled to the input terminal, and an emitter coupled to the power supply terminal.

12. A squaring cell according to claim 8 wherein:

the grounded base transistor has a collector coupled to the output terminal, a base for receiving the bias signal, and an emitter coupled to the input terminal;

the current mirror includes:

a diode-connected transistor having a collector and base coupled to the input terminal and an emitter coupled to a power supply terminal, and

a mirror transistor having a collector coupled to the output terminal, a base coupled to the input terminal, and an emitter coupled to the power supply terminal.

13. (Cancelled)

14. A squaring cell according to claim 8 wherein the bias signal generator includes:

two diode-connected transistors coupled in series between the input terminal and a power supply terminal; and

a current source coupled to the diode connected transistors to cause a bias current to flow through the diode connected transistors.

15. A method according to claim 1 wherein limiting the input signal to a range in which the output function of the transistor cell approximates a square-law comprises limiting the input signal to less than about four times the bias current.